

# A One Metre Robotic Telescope for Western Canada

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## GOALS

To solicit support and insight for this project as we plan a proposal to Canada Foundation for Innovation

To develop collaborations with colleagues

## ABSTRACT

1-m class telescopes are arguably the workhorses of modern astronomy and represent an excellent return of science for a relatively modest capital investment. Such instruments can be used in large-field survey work, high precision photometry as well as in providing HQP opportunities for undergraduate and graduate students. Currently there exists a dearth of such instruments in Canada and in the prairie provinces specifically. In this poster we argue for the development of a 1-m, robotic instrument to be situated in western Canada. The proposed instrument will address two central concerns. First, the instrument that we envision will be multi-purpose and through appropriate optical design will function as both a wide field survey instrument and a narrow field instrument capable of high precision photometry. A remote, robotic access telescope will also maximize on-sky efficiency and data output. Second, this telescope will serve as a prototype for a similar remote telescope for the high arctic. Lessons learned in this project should provide valuable insights into many of the issues expected for operation of a remote telescope in the arctic (extreme cold, problems of data transmission etc). We solicit comments and expressions of interest from other researchers who would benefit from such an instrument.





Robotic Telescopes in North America				
Project	Location(s)	Telescope(s)	Purpose	Status
Antipodal Transient Observatory (ATO) (Washington Univ., IIA Bangalore)	Sonoita/Arizona/USA, Mt. Saraswati/India	2x0.50m Torus	GRB	Being commissioned
Automatic Planet Finder (APF) (Carnegie Inst., San Francisco State Univ., Univ. Berkeley, Lick Obs.)	Mt. Hamilton/CA/USA	1x2.40m EOST	exoplanets	Being commissioned
Automatic Radio-Linked Telescope (Western New Mexico Univ.)	Silver City/New Mexico/USA	1x0.44m	Novae, SNe	In operation
Carl Sagan Observatory (Univ. Sonora)	Cerro Azul/Mexico	Coronado Inst. Group 1x0.55m	SNe, education	Under construction
Explosive Transient Camera (ETC) (MIT)	Kitt Peak/Arizona/USA	16x0.03m	GRB	In operation since 1991
Fairborn Observatory (Fairborn Obs.)	Patagonia/Arizona/USA	Home of many	service	In operation
Las Cumbres Observatory (science) (large consortium lead by LCO)	Haleakala/Hawaii/USA, Siding Spring/AU	2x2.00m TTL	service, education	Being commissioned
Las Cumbres Observatory (education) (large consortium lead by LCO)	Haleakala/Hawaii/USA, Siding Spring/AU, Cerro Pachon/Chile, La Palma/Spain, Sutherland/SA	T12x0.40m	education	Under construction
Four-College Automatic Photoelectric Telescope (Villanova, Citadel, Charleston College, University of Nevada/Las Vegas)	Patagonia/Arizona/USA	1x0.80m APT	monitoring	In operation
Global Network of Automatic Telescopes (GNAT) (GNAT)	Tucson/Arizona/USA	1x0.50m SciTech	service	Being commissioned
Hanna City Robotic Observatory (private)	Illinois/USA	1x0.21m Meade	service	In operation since 1997
Hungarian Automated Telescope (HAT-1) (Konkoly & Steward Obs.)	Kitt Peak/Arizona/USA	1x0.06m	monitoring	In operation since 2001
Iowa Robotic Telescope Facility (IRTF) (Univ. Iowa)	Iowa City/Iowa/USA, Sonoita/Arizona/USA	1x0.18m, 1x0.50m	education	In operation
Katzman Automated Imaging Telescope (KAIT) (UC Berkeley)	Lick Obs./California/USA	1x0.76m	SNe	In operation since 1989
Lincoln Near Earth Asteroid Research (LINEAR) (MIT/Lincoln Lab)	Socorro/New Mexico/USA	1x1.00m GEODSS	NEO	In operation since 1998
Livermore Optical Transit Imaging System (LOTIS) (LLNL)	Livermore/California/USA	4x0.11m	GRB	In operation since 1996
H. S. Mendenhall Observatory (Okla. State Univ.)	Stillwater/OK/USA	1x0.35m, 1x0.60m	exoplanets, NEO	Under construction
Monitoring Network of Telescopes (MNET) (Univ. Göttingen, McDonald Obs., SAAO)	Mt. Locke/Texas/USA, Sutherland/South Africa	2x1.20m Hallmann	service, education	Being commissioned
PAIRTEL (Harvard/SAO CTA)	Mt. Hopkins/Arizona/USA	1x1.30m	GRB, exoplanets, SNe	Being commissioned
Palomar 60" (CalTech)	Mt. Palomar/CA/USA	1x1.52m	GRB	In operation
Phoenix 10" (Franklin & Marshall College)	Patagonia/Arizona/USA	1x0.25m	monitoring	In operation since 1983
Puckett Observatory (private)	Mountaintown/Georgia/USA	1x0.60m RC, 1x0.50m	SNe	In operation
RAPid Telescope for Optical Response (RAPTOR) (LANL)	Fenton Hill/New Mexico/USA	4x0.15m, 1x0.30m	survey	In operation
Remote Obs. for Var. Obj. Research (ROVOR) (Brigham Young Univ.)	Provo/Utah/USA	1x0.60m Autoscope	monitoring, AGN, GRB	Under construction
RoboScope (Univ. Indiana)	Morgan-Monroe/Indiana/USA	1x0.41m Boller-Chivens	monitoring	In operation since 1990
RoboSky (commercial)	Ontario/Canada	2x0.20m Meade	education	In operation
Robotic Optical Transient Search Experiment (ROTSE-I) (Los Alamos, LLNL, Univ. Michigan)	Los Alamos/New Mexico/USA	4x0.11m	GRB, surveys	In operation since 1998
Robotically Controlled Telescope (RCT) (Western Kentucky Univ., S. Carolina State Univ., Planetary Sci. Inst., Berkeley)	Kitt Peak/Arizona/USA	1x1.30m	service	Being commissioned
Spectrafit (Univ. Indiana)	Morgan-Monroe/Indiana/USA	1x1.25m	spectroscopy	In operation since 1999
Super-LOTIS (LLNL, Clemson)	Kitt Peak/Arizona/USA	1x0.60m upgraded Boller-Chivens	GRB	Being commissioned
TENAGRA Observatory (private)	Oregon/USA, Patagonia/Arizona/USA	2x0.30m Celestron, 1x0.060m SciTech, 1x0.81m SciTech	SNe, NEO	In operation
Tennessee Automatic Photoelectric Telescopes (Tennessee State Univ.)	Patagonia/Arizona/USA	1x0.30m, 1x0.60m, 1x0.76m APT	monitoring	In operation
Tennessee Spectroscopic Survey Telescope (Tennessee State Univ.)	Patagonia/Arizona/USA	1x2.10m	spectroscopy	Being commissioned
Transient Object Automated Search Telescope (TOAST) (Univ. of North Dakota)	Grand Forks/North Dakota/USA	1x0.25m Meade	GRB, SNe, astrometry	In operation since 2003
UVI Observatory (Univ. Virgin Islands, College of Charleston, S. Carolina State Univ.)	St. Thomas/Virgin Islands/USA	1x0.50m OMI/Torus	GRB	Being commissioned
Wolfgang-Amadeus (Univ. Vienna, AIP)	Patagonia/Arizona/USA	2x0.76m APT	monitoring	In operation since 1996

# Why a 1 Metre Robotic Telescope in Canada?

Currently there are no robotic observatories in Canada with aperture greater than 0.25 m

Of the 36 robotic installations in North America (in operation or proposed) only 7 support instruments with apertures 1.0 m or greater

1 m class is at the upper limit of easy fabrication techniques and could correspond to a useful size for Arctic deployment. It offers interesting current science capabilities.



# Intended Science Outcomes:

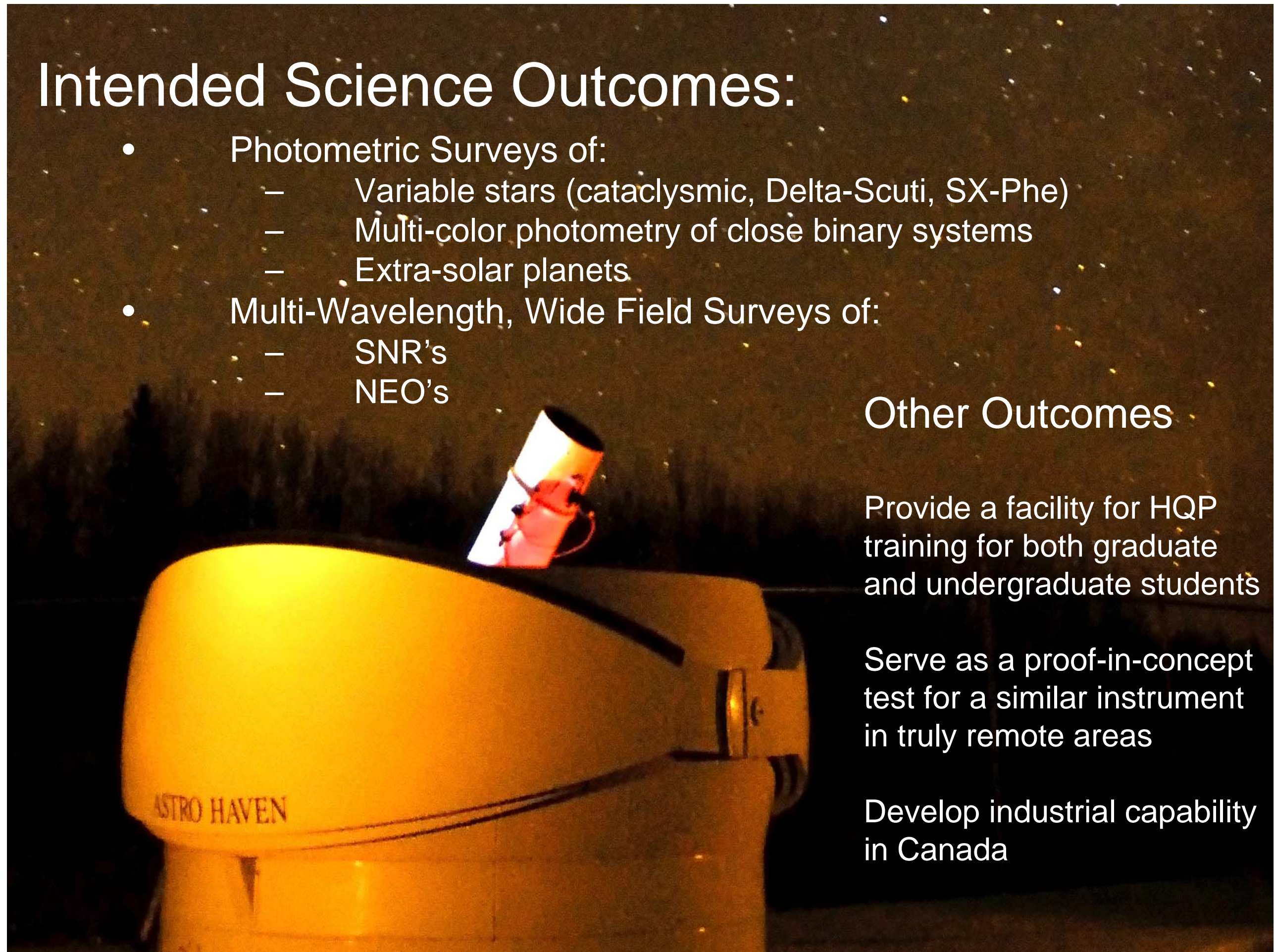
- Photometric Surveys of:
  - Variable stars (cataclysmic, Delta-Scuti, SX-Phe)
  - Multi-color photometry of close binary systems
  - Extra-solar planets
- Multi-Wavelength, Wide Field Surveys of:
  - SNR's
  - NEO's

## Other Outcomes

Provide a facility for HQP training for both graduate and undergraduate students

Serve as a proof-in-concept test for a similar instrument in truly remote areas

Develop industrial capability in Canada





# Optical and Mechanical Design

- 1.0 m aperture prime focus configuration (f/3 or f/4)
- Fork mounted, friction drive
- OTA Serurier truss design





# AURT Experience

- AURT is a 0.4m f/5 Newtonian
- AURT had first light in 2005
- AURT has been tested but not used in winter





# AURT Experience

- Clamshell open dome – enclosed would be better
- Friction drives on both axes
- Dark sky location near Athabasca (but under threat)





# AURT Experience

- Computer control under Windows – linux would be better
- Fork mount – good design to go forward with
- Remote access possible using Remote Desktop





Consumer grade CCD (Starlight Express MX series colour  
3k×2k pixel) camera as prototype at Newtonian focus





# References:

- Benn, C. & Sanchez, S., 2001 PASP, **113**:385-396
- Hellemans, A., 2000 Nature, Vol 408, 2 November:12-15

